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COMPRESSED AIR,

AS

A THERAPEUTIC AGENT,

IN THE

TREATMENT OF CONSUMPTION, ASTHMA, CHRONIC
BRONCHITIS, AND OTHER DISEASES.

BY

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WITH A PREFACE,

BY

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PREFACE.

THE reader of this Essay upon the Compressed-Air Bath, will probably be struck with the unhesitating manner in which Dr Simpson writes of the *general* curability of consumption. He will be inclined, perhaps, to refer this opinion either to an over-sanguine spirit, or else to incorrect diagnosis. For consumption has, from the earliest time till now, been considered by the medical profession as generally *in-curable*. I can assure the reader, however, that the statements of Dr Simpson in this paper are neither at all exaggerated, nor the result of false diagnosis. Each of the cases on which they are based was watched with great care, both by Dr Simpson and myself. The lungs were tested, and the organs thoroughly examined, both by percussion, and by means of the stethoscope, at the same hour each week. We were most exact and scrupulous in marking down the symptoms at the moment, whether these should give evidence of improvement, or indicate any falling off. Indeed, we had resolved to allow no bias, either for or against the air-bath, to interfere with our obtaining and recording exact and literal transcripts of the cases, in their minutest features, and throughout their various excursive phases, under the process of treatment.

It may serve to show more clearly the real value and significance of the results brought out by Dr Simpson's statements, that I should here briefly describe the nature of the treatment previously employed by me in phthisical cases, the extent of the success obtained by means of it, and the precise point at which its efficiency was found to terminate. The real position and importance of the air-bath will thus be apparent, as carrying out farther, and decisively completing a treatment, which, otherwise, and *per se*, must have been considered as only partially, and up to a certain point, successful.

Ten years ago, I refused to receive at Ben Rhydding, for treatment, any cases of consumption which had advanced much beyond the incipient stage; and that, partly, because I believed they could be treated better elsewhere, and partly, because all the so-called cases of consumption which were said to be cured by hydropathy, and which I had examined, were merely cases of severe chronic bronchitis, with or without a dilated bronchial tube. Besides, many cases, really consumptive, in regard to which I had myself been consulted after they had been under hydropathic treatment, I found had been the worse rather than the better from the process. Circumstances, however, were different with those phthisical patients who requested admission into my hospital. I had no hesitation in receiving them into the hospital, because it was removing them from unhealthy conditions, and meagre sustenance, to a healthy atmosphere, well-ventilated rooms, and a nourishing diet. Such being the state of matters, I resolved carefully to test the effect of hydro-therapeutic treatment in phthisis. I examined the cases with great care twice every week, and marked down with the greatest possible exactness the results of the treatment. I shall now state, generally, the treatment employed. It would be unsuitable to give here the treatment of each individual case; for that varied greatly, and depended much upon the temperament of the patient, the state of the constitution, the stage of the disease, and on the *intensity* of the tubercular matter towards disintegration. I shall merely endeavour to give a *general* idea of the treatment, which had for its object to elevate the vital powers, strengthen the digestive organs, increase the action of the skin, and promote those secretions which were either dormant or deficient in quantity; also to arrest, if possible, the deposition of tuberculous matter in the lungs, to invigorate their mucous membranes, and to assist the cavities in cicatrising. To effect these objects, I employed, at different times, and in a varied way, one or more of the following appliances, some of which I used almost in every case, while others, I employed only rarely, viz.:—wash down; dripping sheet; lengthened frictions of the chest; wet compresses, carefully covered, over the chest and stomach; half rain-bath; full rain-bath; towel envelope; and the internal use of water. I ordered cod-liver oil, the wine of iron, the citrate of iron, the syrup of the iodine of quinine and iron, with a full, nourishing diet, and now and then stimulants; exercise in the open air during the day and in the morning, when the weather was fine,

with directions, however, not to go out at night, or in damp, rainy, or very cold weather. The results of this treatment were increased general vigour, the disappearance of all febrile symptoms, the removal of indigestion, diminished expectoration and cough, increase of weight, entire removal of the night sweats, arrest of further deposition of tubercular matter in the lungs, diminished secretion of muco-purulent matter into the air-tubes, increase of appetite, greater expansibility of the walls of the chest, and a sense of greater ease and freedom in ascending the hills. Beyond these improvements I could not carry my patients. I was unable, in severe cases, to remove entirely the mucous râles, or to prevent the walls of the cavities from secreting muco-purulent matter. Moreover, I could never satisfy myself of the re-absorption of deposited tubercular matter to any great extent.

I continued these experiments in my hospital for fully two years; and when I had satisfied myself of the efficiency, thus far, of this mode of treatment in phthisis, I then began to receive similar cases into Ben Rhydding. I still, however, refused to allow those patients to remain during the winter, afraid lest the weather might prove too severe for them. After a while, my mind on that point also changed. Several patients had come to me, so very seriously ill, that their physicians expressed it as their opinion, that they could not live above a month or two, and I was myself inclined to the same opinion; but, nevertheless, they *would* come. These patients gradually improved; and they became so satisfied of the efficacy of the treatment, that, when I proposed to them to go south during the winter and spring months, they requested permission to remain at Ben Rhydding, believing themselves to be safer here than anywhere else. They did remain, but were not permitted to go out in the mornings before 10 o'clock, nor after 4 P.M. These patients, instead of falling back, as I had feared, on the contrary, continued to improve; and, indeed, they benefited more during the cold winter months than they had done in the previous summer ones. Finding such to be the case, I had all my passage windows nailed up, and the entire house ventilated from the roof by Watson's unequalled ventilators, by which means all draughts were prevented; and, at the same time, I had the passages heated by means of steam-pipes. The result of these improvements was, that Ben Rhydding became as warm and as comfortable in winter as in summer. I now receive, without any hesitation, phthisical patients during the severest

weather, and, what will perhaps appear strange, they nearly all do well. They go out during the day, in almost all sorts of weather; and even during the late severe frost, with snow upon the ground, and the temperature ten degrees below freezing point, patients, with only half a lung to breathe by, took exercise in the open air, and with decided advantage. I allow no respirators; for I consider them to be not only of no benefit, but, on the contrary, decidedly prejudicial. The patients are warmly clad, avoiding such a weight of clothing as would be oppressive; the feet are always kept dry and warm, and the clothes are ordered instantly to be changed whenever they happen to become in the least degree damp. They are not permitted to go out before breakfast, or after three or four o'clock in the afternoon. I fully concur in the following extract, taken from a work lately published by one of the oldest and most noted physicians in America, and I consider the recommendations given by him to be both safe and salutary.' "Next to the diet, and of all things most important, is exercise in the open air. This should be carried as far as the vigour of the patient will permit. It should not be done rashly, but boldly. If possible, the patient should be made to have faith in it, for, without this, he is not likely to pursue it as far as he can, and then he will not derive from it all the benefit which it can afford." "But in the day-time, the patient should not be kept within doors by clouded skies, nor by east winds, nor by slight falls of rain or of snow. Even in tempestuous weather, the more hardy ones may drive out somewhat. It is well for the patient to feel that the *risk is in staying in the house*, and not in going out of it." I have thus found a judicious internal and external use of water, full nourishing diet, stimulants along with the analeptic treatment, exercise in a pure bracing atmosphere, and that even during the winter months, to be of the first importance in the treatment of phthisis.

But, with all these means, I was unable to proceed farther towards a cure than I have stated. I was unable to cause the absorption of tubercular matter to any considerable extent, or to invigorate, in very bad cases, the mucous membrane of the air-tubes sufficiently, so as to arrest their increased secretion of muco-purulent matter; or, by stimulating the walls of the cavities, to dry up these cavities,

¹ *Letters to a Young Physician*, pp. 175 and 177. By James Jackson, M.D. LL.D., Professor Emeritus of the Theory and Practice of Physic in the University of Cambridge, U.S., etc. etc.

and allow of their cicatrising. The consequence of this was, that the patients, so long as they continued to reside here under treatment, did well; but, when they returned home, the disease was very apt, after a few months, to awake into renewed activity. To obviate, if possible, these risks, and surmount these impediments, trial has been made by me, during the last five years, of almost every kind of inhalation, and every other remedy which has been recommended; but with little or no advantage, except, perhaps, from Dr Ramadge's tube and inhaler. The aid afforded, even by the latter, was very inconsiderable; so that at length I began to find my expectations of attaining the end so much desired fading gradually away, and my efforts becoming paralysed. And many a sad thought I have often had, when I contemplated the unspeakable good waiting to be done, and beheld the many gentle or noble lives that were wasting away visibly under my very eyes, and yet felt myself unable effectually to succour or to save them.

But oftentimes, when we are on the very verge of despair, a helping hand is unexpectedly stretched out to us, and a power may suddenly be placed within our reach, which, if duly seized and improved, can convert the dismal swamp itself into a region, if not of bliss, at least of comparative safety, and even of happiness. It was so in this instance, and the auspicious aid was presented in the compressed air-bath. My earnest thanks are due to the gentleman who brought under my notice the invention. It will prove, I trust, that great service has been rendered by him to the healing art and to the interests of humanity. By the assistance of an able engineer, I had a very excellent and efficient air-bath constructed, which has now been in constant use for several months, and fully twenty patients are daily treated by means of it. The results are to me very extraordinary, nor does more seem to me needed for now completing, in combination with the appliances described above, a full and successful treatment of phthisis. It does what no other method, or combination of methods, known to me, can effect. It invigorates, by a healthy and suitable stimulation, the mucous membrane lining the air-tubes, and the secreting surface of the cavities, and so stops their large secretion of muco-purulent matter; it enables the cavities to cicatrise; and it causes the absorption of the tubercular matter deposited in the lungs. It assists in the increased animalization of the blood, and brings back the *periods* in cases in which they had ceased for years, and when nothing could be found to restore them.

In conclusion, I can, with full confidence, declare, that I regard the associated treatment which has now been referred to, as the only real and efficacious means which we possess for coping with phthisis. Its rapidity in lessening the secretion of muco-purulent and tuberculous matter, in causing the absorption of the latter, with its efficiency in renewing a healthy tissue in the softened and relaxed mucous membrane of the lungs, and its power of restoring the respiratory organs to their original and healthy condition, is such as is possessed by no other means of cure with which I am acquainted. Moreover, I have an equally strong belief of the efficacy of this treatment in even the very worst cases of chronic bronchitis and asthma.

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THE COMPRESSED-AIR BATH,

AND ITS

THERAPEUTIC EFFECTS.

It seems not a little remarkable, that a mode of treatment of diseases of the chest, which seems to have been in successful operation in France for the last twenty years, and whose action is susceptible of at least as satisfactory an explanation as a great majority of the remedies we are daily in the habit of using, should have attracted so little the attention of the medical profession in this country. Beyond a few remarks by Dr Walshe, in a note to the second edition of his work on Diseases of the Lungs and Heart, and a review of the works on the subject by Bertin and Pravaz, in the *British Journal of Homœopathy* for January 1856, we are not aware of any account in English of the use and effects of this agent.

Much as has been done within the last half century, by the aid of physiological and pathological research, and clinical observation, to improve the treatment of the most prevalent and fatal class of diseases of our climate, it is still an imperative duty to inquire, in a candid and unprejudiced spirit, into the merits of any measures which scientific men, whether at home or abroad, have thought worth their while to try, and believe to have proved useful in their hands.

Such is the case with the compressed-air bath, now for the first time introduced into this country by Dr Macleod of Ben Rhydding.

We purpose, therefore, in the following pages, to give some account of the history of the use of condensed air in the treatment of disease, the mode of its application, its therapeutic effects, and in what diseases it is chiefly applicable.

The idea that atmospheric air, altered in density, whether by excess or diminution, is capable of producing therapeutic effects on the human body, is by no means of recent origin; for, not to mention the local use of rarefied air in the application of cupping-glasses—a

practice of unknown antiquity—we find that, in the year 1662 (as related by Mr W. Bernard, in his work “on the Warming and Ventilation of Houses”), Dr Henshaw, a countryman of our own, actuated by the consideration of the salutary effects of change of climate, which he seems to have considered in great measure due to differences of atmospheric pressure, constructed a chamber, in which, by means of a large pair of organ-bellows, furnished with a suitable arrangement of valves, the air could be condensed or rarefied at pleasure. He appears to have employed condensed air in the treatment of acute diseases, and rarefied for those of a chronic character, on what principle we are unable to say, not having access to his work. The amount of increase or diminution of pressure was regulated by the patient’s feelings, especially as regarded his respiration—the air being condensed or rarefied, according to the nature of the case, “as long as the patient continued to feel his breathing to be easy, or at least not in any way rendered more difficult.” Dr Henshaw states that “cramping” sometimes ensued when the air was much rarefied, and that difficulty of breathing oftener happened when inhaling condensed than attenuated air; which latter statement we shall find not to be borne out by the use of compressed air under proper conditions. It does not appear whether Dr Henshaw had any means of renewing the air in his chamber, or “domicilium,” as he calls it, when its purity was impaired by respiration—a circumstance which would, of course, seriously interfere with any benefits to be expected from the measure; nor are we aware at what rate, or to what extent, he rarefied and condensed the air. His statement of the effects produced by this mode of treatment is interesting, as we shall find that several of them are manifested under the use of compressed air, as at present practised. “By the use of the domicilium,” he says, “the usual amount of insensible perspiration may be doubled. In time of health this domicilium is proposed as a good expedient to help digestion, to promote insensible perspiration, to facilitate breathing and expectoration, and, consequently, of excellent use for the prevention of most affections of the lungs.”

From whatever cause, but most probably from insufficiency of apparatus, and want of proper precautions in its application, Dr Henshaw’s experiments do not seem to have produced any definite results, such as to encourage others to pursue a similar course of investigation; and the subject seems to have fallen into unmerited neglect, the only notices of it we are aware of being the proposal of the effects of condensed air on animal and vegetable life, as a subject for competition by the Royal Society of Sciences at Haarlem, about sixty years ago, a proposal which seems to have met with no response—and the suggestion, at a later period, by Sir J. Sinclair, that beneficial results might be expected from its employment in certain states of disease—until M. Emile Tabarié commenced, in 1832, a series of researches on the effects on the body of the application, both locally and generally, of air of different densities, which resulted in the

treatment by means of the “Bain d’air comprimé.” He appears to have been led to this investigation by a consideration of the effects produced on the system by the ascent of high mountains and in balloons, which are, in a great measure, merely an exaggeration of what many experience frequently on a sudden fall of the barometer. Now, as in the opposite condition, under increased pressure of the atmosphere, opposite sensations are experienced, indicative of a more active and healthful state of the system, he was led to expect that, under proper management, a still further increase of pressure might be of advantage in the treatment of some diseased conditions. M. Tabarié further considered that an element so indispensable as atmospheric air to the existence of all organised beings, ought also, by modification of its physical and chemical qualities, to become an inexhaustible source of beneficial influence on the system.

It appears that Dr Junod, unaware of M. Tabarié’s researches, applied himself, about the same time, to a similar course of investigation; but, from an essential difference in the method of application, he does not seem to have arrived at equally satisfactory results with M. Tabarié, his coadjutor M. Bertin of Montpellier, and Dr Pravaz, Director of the Orthopædic Institution of Lyons, the latter of whom commenced the use of the air-bath in 1836, apparently immediately after the announcement of the results of M. Tabarié’s researches. The treatment by compressed air, then, has been in use for the last twenty years; and appears, from the works of Bertin and Pravaz,¹ not only not to have disappointed, but to have far exceeded in success, the anticipations formed of it.

Let us now describe the apparatus necessary in this mode of treatment, and the manner of its application.

The air-bath is a chamber constructed of iron plates, rivetted together like those of the boiler of a steam-engine, so as to be perfectly air-tight, provided with a close-fitting iron door, and several small windows, each of a single piece of strong plate-glass. The interior, lined with wood, is furnished with seats, a couch for weak patients, means of communication with the attendant by a bell or whistle, and a contrivance for passing in or out small articles, such as letters, without disturbing the pressure of the air inside. A steam-engine, of power proportioned to the size of the chamber, works a pair of force-pumps, which communicate indirectly with the chamber by a pipe opening under its floor, which is pierced with numerous small apertures, so that the air may enter with as little noise as possible. From the roof of the chamber, a pipe similarly arranged passes out; and this is furnished with a screw-valve, by means of which the amount of air passing off may be regulated,

¹ *Etude Clinique de l’emploi et des effets, du Bain d’air comprimé dans le traitement de diverses maladies, etc.* Par M. E. Bertin. Paris 1855.

Essai sur l’Emploi Medical de l’air Comprimé. Par le Docteur Ch. G. Pravaz. Lyon. 1850.

while the amount of that which enters is regulated by the rapidity of motion of the engine and pumps. While the air is being condensed, and after it has been brought to the maximum pressure desired, a sufficient quantity of air is constantly allowed to enter and escape, to keep that in the chamber of sufficient purity for respiration. By means of a barometric tube placed outside, and communicating by its upper extremity with the atmospheric pressure, while the mercury at the lower end is subjected to that of the air in the interior of the bath, the attendant is constantly made aware of its amount, and can regulate it by the valve in the escape-pipe, and by the working of the steam-engine. An apparatus is attached, also, by which the temperature of the air entering the bath can be regulated, as it undergoes considerable variation during the condensation and subsequent rarefaction of the air, and also by the heat evolved by the friction of the pumps.

M. Tabarié's researches led him to the conclusion, that the beneficial effects of the use of condensed air are best attained by raising the pressure gradually, maintaining it steadily at the pre-determined maximum for some time, and then lowering it as gradually as it was raised. He believes that the transition period has a disturbing action on the system, while the period of continued elevated pressure restores the normal calm and regularity of the functions,—thus permitting the condensed air to exert its beneficial effects. He believes, also, that, as a general rule, the pressure ought to be raised to about $\frac{2}{5}$ ths of an atmosphere, that is, about 6 lbs. per square inch above the ordinary pressure of the air, at the rate of one pound in five minutes, the rarefaction taking place at the same rate. The period he generally prescribes for the continued pressure is an hour, the entire sitting thus occupying two hours. Occasionally, he employs lower pressures, and shortens the time of sitting; and Dr Pravaz, believing that the strength of the patient ought to be taken into account, frequently employs the lower degrees. At Ben Rhydding, we have found that the duration of the bath, and the amount of pressure, require to be regulated with reference to the character of the disease, the organ in which it is situated, the vital force of the patient, and the condition of the nervous system. Indeed, we find that the same laws which regulate the use of water in the treatment of disease, apply to the employment of compressed air as a therapeutic agent. It is interesting to observe how the medical employment of one natural stimulus unexpectedly proves the correctness of the use of another.

The first experiments of Dr Junod, conducted, as they were, without the precautions observed by M. Tabarié, the transitions being rapid, and the pressure high, were productive of results calculated to deter from farther trials, such as increased frequency of pulse, cerebral excitement, and a state resembling intoxication; and we need not be surprised, therefore, that so great an authority as Majendie declared the system to be not susceptible of application in

medicine. M. Tabarié's researches, on the other hand, have shown to what causes these results were due, and how they may be avoided; and, under the restrictions he has established, has rendered compressed air a therapeutic agent of high value, and of perfect safety.

The sensations experienced by a person in health, when subjected to the action of the compressed air, are few—with some individuals almost none. The first is what has been so frequently noticed in descents in the diving-bell, a feeling of pressure in the ears, in consequence of the Eustachian tube not immediately becoming pervious to the condensed air. This, in most persons, gradually passes off, though in some the feeling amounts to considerable pain, and is continuous; but, generally, it ceases when the pressure becomes steady, and, after a few baths, it is very often not felt at all. It can commonly be relieved by swallowing a few times in succession, or, if that does not succeed, by making an expiratory effort with the mouth and nostrils closed. In a very few cases, the pain has been so severe, as to necessitate lowering the pressure a little, and it could then commonly be gradually raised again without the same disagreeable effect. In other cases, the Eustachian tube has not become pervious till after several baths. The sensation of pressure returns generally while the air is being rarefied, from the reverse of the circumstances which caused it at first, the condensed air now not escaping readily from the internal ear.

An increased flow of saliva is commonly perceptible as the pressure rises, produced, in part, perhaps, by the mere mechanical effect of that pressure on the salivary glands, but principally, we believe, by the stimulant action of the compressed air on the secreting membrane.

Beyond the effects we have just mentioned, and a feeling of increased facility and diminished frequency of respiration, which it may require attention to observe, and sometimes an increased flow of spirits, a healthy individual does not, in general, experience, while in the bath, any sensation unusual to him while under the ordinary pressure of the air. But in diseased conditions, it is otherwise. We shall now proceed, therefore, to show the effects of compressed air in some of these.

To commence, then, with the most readily discoverable, both by the patient and the observer, we find, that in most cases of difficulty of breathing, arising from lesions of the tissues composing the air-passages and pulmonary structure, the patient, on being subjected to the increased pressure in the air-bath, becomes sensible of a greater facility of breathing, a feeling of greater expansion of the chest, and of increased comfort; and if his respirations have previously been too frequent, their frequency is diminished.

The cause of these phenomena seems to be, in the first place, as Dr Pravaz has well shown, a mechanical one, arising from the increase of pressure in the lung. On superficial consideration, we are apt to suppose the acts of inspiration and expiration to be ana-

logous to the actions of a pair of bellows, which will, obviously, be opened and closed with equal ease, whatever be the pressure of the atmosphere. But it is otherwise with the respiratory movements, as a little consideration of the forces in action, and the relations of the parts concerned, will show. In inspiration we have, on the one hand, tending to expand the chest, the force exerted by the muscles, and the pressure of the air entering the lungs; on the other, tending in an opposite direction, the elasticity of the thoracic walls, the atmospheric pressure on their external surface, and the elasticity of the lungs and bronchi. From the relation of the lungs to their containing cavity, although, in ordinary circumstances, the costal and the pulmonary portions of the pleuræ are constantly in contact, without being, save at their points of reflexion, united, there is yet, from the elasticity of the pulmonary tissue, a constant *tendency* to the formation of a vacuum in the pleural cavity. We know, that if, after death, the thoracic walls being contracted as far as possible, an opening be made in them, the lung will contract still farther. In life, then, while the walls remain perfect, the formation of a vacuum between the lungs and the walls of their containing cavity is prevented by the pressure of the air in the lungs acting against their elasticity, and not counter-balanced by a similar pressure on the pleural surface of the lung, as it is when air is admitted by puncturing the thorax. The correct statement, therefore, of the conditions necessary for inspiration, is, that the force exerted by the inspiratory muscles, *plus* the difference between the atmospheric pressure and the elasticity of the lungs, should exceed the resistance offered by the elasticity of the thoracic walls and the pressure of the atmosphere on them. It follows, then, that if the atmospheric pressure be diminished (or the elasticity of the lung increased), although it would, at first sight, appear that the expansion of the chest would be facilitated, in consequence of the diminished pressure on its exterior, yet, from the increased tendency to vacuum in the pleural cavity, the act of inspiration becomes, in reality, more difficult of performance, as we know to be the case when the atmospheric pressure is diminished, by ascending to any great elevation above the ordinary level. On the other hand, if the pressure of the air be increased, or the elastic force of the lungs diminished, we have an opposite effect—the tendency to vacuum becomes less, and the lung following more readily the expansion of the thoracic cavity, the act of inspiration is facilitated, and the expansion of the lung is increased, the air entering more freely into its vesicles, within certain limits. During inspiration, the difference between the atmospheric pressure, and the resistance offered by the elasticity of the lung, is constantly diminishing, the latter increasing as the lung is expanded. From considerations such as these, then, Dr Pravaz draws the following conclusion:—“ Si l'on reconnaît que la réaction des divisions bronchiques est une résistance qui croît avec l'expansion de l'organe; si l'est certain, d'un autre côté, que dans les conditions ordinaires de

la vie l'inspiration est loin d'avoir l'étendue que comporterait la disposition anatomique des parois thoraciques, on ne peut douter que chez un grand nombre de sujets, et particulièrement chez ceux qui, menant une vie sédentaire, n'ont besoin, pour l'hématose, que d'un conflit médiocre avec l'atmosphère, la retractilité de tissu n'ait réduit notablement le *maximum* de capacité que peuvent acquérir les poumons sous la pression ordinaire, et par suite l'ampliation habituelle de la cavité pectorale; des lors n'est il pas manifeste qu'en augmentant cette pression et elevant ainsi à une plus haute puissance la force qui lutte contre la réaction du poumon, on doit étendre la limite supérieure de son développement propre, et consecutivement celle de l'expansion de la cage thoracique sous l'effort des muscles inspireurs, effort qui devient promptement impuissant lorsque la tendance au vide, qui a lieu entre les deux plèvres pendant l'inspiration, dépasse une certaine mesure?"

He remarks farther, that an increase of atmospheric pressure, by augmenting the tension of the intestinal gases, will oppose a more unyielding "point d'appui" to the diaphragm, thus diminishing slightly the expansion of the thorax in its vertical direction, but more than compensating for this, by its increased expansion in the antero-posterior and lateral diameters—a point of considerable importance in some pulmonary affections. He has, moreover, found, by experiments many times repeated, that under different degrees of increased pressure of the air, the capacity of the lungs increases up to a certain limit, varying in different individuals, above which limit it returns to its normal extent, or even falls below it. He draws the following conclusions from his experiments and reasonings:—

"1. L'étendue de l'inspiration forcée ou le développement du poumon, croît avec la pression atmosphérique, jusqu'à une certaine limite qui paraît déterminée en général par la vigueur des sujets.

"2. La pression atmosphérique cesse de favoriser l'ampliation des organes respiratoires lorsqu'elle arrive à dépasser la différence toujours décroissante qui existe entre l'effort des muscles inspireurs et l'élasticité des parois thoraciques."

This, then, appears to be one of the ways in which compressed air acts in relieving dyspnœa: but there are other actions, partly connected with this, and partly independent of it, which we now proceed to consider. The volume of air introduced into the lungs, while it is composed of the same relative proportions of its component gases, contains a greater absolute amount of each, than at the ordinary pressure of the atmosphere. We have thus a greater amount of oxygen presented to the blood, and that under circumstances peculiarly favourable for its absorption; for the mutual actions between the air and the blood taking place with the intervention of a moist membrane, it follows, as has recently been shown, that the interchange of gases takes place by the laws of absorption, and that the amount of oxygen absorbed will be proportional to the pressure of that gas in the air-vesicles. With regard to the elimi-

nation of carbonic acid under these circumstances, experiments undertaken at the instance of Dr Pravaz, by Messrs Hervier and Saint Lager, have demonstrated—1st, That the quantity of that gas exhaled in the compressed-air bath, rises above the normal proportions up to the pressure of 10 to 12 centimetres (about 3·9 to 4·7 inches); above this limit, the lung exhales less carbonic acid than before the bath. 2d, That the consecutive effect of the compressed air, on coming out of the bath, is to increase the exhalation of carbonic acid. This effect, which continues for several hours, does not attain its maximum till a certain time after the bath. These facts are, in part, explained by the effect of increased pressure in preventing the excretion of the gas, and by the circumstance pointed out by Dr Harley (*Brit. and For. Med. Chir. Review*, Oct. 1856), that a certain time is required for the chemical combination of the oxygen with the different constituents of the blood, and consequent elimination of carbonic acid. There can, we think, be little doubt, that several of the known effects of the compressed-air bath, such as the increased appetite, buoyancy of spirits, and general improvement of the functions, are owing, in a considerable degree, to the higher oxygenation, and consequent increased animalization of the nutritive constituents of the blood, facilitating the change of the tissues, assisting in the elimination of morbid products, and especially influencing the nervo-muscular apparatus, for whose activity so large a quantity of oxygen is demanded; in fact, stimulating generally the vital force of the system, in this way acting in harmony with the therapeutic use of water and the other external stimuli. This suggests the application of this remedy in diseases depending on, or accompanied by, poverty of the blood, such as the various forms of scrofula, chlorosis, leucocythemia, purpura, etc.

But, further, this increased supply of oxygen to the blood has, doubtless, another effect, of the utmost importance in a large class of diseases, depending on congestion of the pulmonary tissues. The experiments of Professor John Reid, of St Andrews, on the circulation of the blood through the lungs in asphyxiated animals, prove that interference with the interchange of gases in the respiratory organs, is followed at once by congestion in them. The increased quantity of oxygen in the air-vesicles, then, in cases where congestion exists, enables the lungs to perform their functions more efficiently, and thus removes congestion of those organs.

But the chief action of the compressed air, is that which it exerts on the mucous membranes. This is most easily seen in cases of chronic congestion of the soft palate, and neighbouring parts, where we have the membrane red, tumefied, soft, and relaxed, with alteration, sometimes approaching to extinction, of the voice, as in the affection called “clergyman’s sore throat.” In such cases, the compressed air has produced relief, even at the first sitting; and by its means, even in long-standing cases, the parts, in a comparatively short period, are restored to their normal condition—the softened,

engorged state of the membrane, and the enlargement of the glands, rapidly giving way.

In similar or allied affections of the mucous membrane of the air-passages, chronic affections of the lining of the larynx, trachea, bronchial tubes, and air-vesicles, the compressed air exerts the same therapeutic influence. In chronic bronchitis, we have a condition of the mucous membrane of the bronchi similar to that we have just described, characterized by injection, thickening, increased or altered secretion. Under the use of the air-bath, we have found all the signs and symptoms dependent on those lesions speedily give way; the signs of excess of mucus in the tubes disappearing, sibilant râles becoming less and less acute, till at last the natural vesicular murmur resumes its predominance; the mucous membrane is, as it were, braced up, the tendency to excessive secretion removed, and the air penetrating more readily into the air-vesicles, the tendency to emphysema is dissipated, and renewed vigour is imparted to the whole system.

The effects thus produced by the compressed air, will in a great measure explain the relief afforded by it in cases of asthma. In this affection, the function of respiration is impeded by narrowing of the air-tubes; whether, as in purely nervous asthma, by spasmodic constriction alone, or, as in the great majority of cases, by a combination of this condition with an irritable, congested, and relaxed state of the mucous membrane, which, whether it be the cause or the effect of the former, must certainly tend to aggravate it during the paroxysm, and increase the susceptibility to future attacks.

The use of compressed air has proved successful not only in relieving asthma during the paroxysm, but also in removing the tendency to those attacks. It acts principally, in such cases, by relieving congestion, diminishing increased secretion, reducing the thickening and relaxation of the membrane, and allaying its irritability; thus permitting to the air a free entrance into and exit from the lungs, and an easier transmission of oxygen gas to the blood, and carbonic acid from it; and thus imparting increased vigour to the whole system, enables it to resist the injurious action of those causes which are apt to bring on the paroxysm. During the attack, also, it has a tendency, by its slowly increasing and sustained pressure, to overcome the spasm of the muscles, and enable them to resume the function which has been assigned to them, of assisting in the removal of the bronchial mucus, an accumulation of which must tend to aggravate, if it is not itself one of the causes of the morbid condition. The relief afforded, during the paroxysm, by the compressed air, may be further explained by the effect I have myself experienced, as well as observed in patients during asthmatic attacks, by the inhalation of a mixture of atmospheric air with a large proportion of oxygen gas, or of the fumes of nitre and chlorate of potass, which agents seem, by increasing the oxygenation of the blood, to stimulate the nervous system, and remove the morbid condition on

which the attack, in part at least, if not entirely, depended. The increased amount of oxygen afforded, as we have already seen, in the compressed-air bath, must have a similar action.

The ordinary treatment of asthma is frequently much embarrassed or rendered abortive by the complication of vesicular emphysema. In whatever way we choose to explain the mode of production of this lesion, there can be no doubt that the morbid condition of the mucous membrane, already described, is, in the great majority of cases, its principal determining cause, whether by the impediment thus offered to the escape of the air from the vesicles, as Laennec first taught, or, as has lately been advanced, by this state causing collapse of the lung, which is by some believed to be the invariable accompaniment and cause of emphysema. And we find, in numerous instances, after the occurrence of emphysema, that this condition of the bronchial mucous membrane continues, and contributes still further to interference with the function of the air-vesicles and pulmonary capillaries, so much impaired by the secondary lesion. Congestion is thus produced, and further alterations are brought about in the structure of the air-vesicles. Now, in the air-bath we possess the means of removing or relieving these conditions. We have already shown its influence in removing the morbid state of the mucous membrane in question, thus giving freer entrance and exit to the air, and relieving, moreover, the strain on the air-vesicles. We have thus the presentation to the blood of oxygen in increased quantity, and under favourable circumstances, and greater freedom of escape for the carbonic acid. The circulation in the blood-vessels ramifying on the walls of the vesicles, if these are not yet entirely obliterated, being thus freed from the congestion which existed in them, the impaired functional activity of the part is restored, its nutrition increased, morbid changes removed, and the tissues, resuming their several offices, have their development and activity augmented in the exercise of these functions. Thus the elasticity of the tissue is called into exertion, and has its force augmented, and the expulsion of vitiated air still farther facilitated. In recent cases of collapse, the condition on which a recent theory lays so much stress as the cause of emphysema, the compressed air, while relieving the condition of the mucous membrane to which collapse is ascribed, will also, by its mechanical pressure in the lung, and the greater facility and extent of respiration afforded, tend to restore those parts to their former condition, which, if the theory be a correct one, will aid the other actions we have described in bringing about a cure of the emphysema. We shall afterwards have occasion to refer to other similar effects of this mechanical action. The cases related by Bertin, as well as some of our own, prove that, by this treatment, the natural vesicular murmur is restored in parts where emphysema had produced a complete, or nearly complete, extinction of it.

M. Bertin believes he has discovered an auscultatory sign of some importance in connection with emphysema, presenting an analogy

to the crepitant rhonchus indicative of the commencement and resolution of pneumonic exudation. The sound is a continuous one, a kind of "bourdonnement," or humming, similar to that heard on holding to the ear a large univalve shell. He has noticed the occurrence of this sound in cases where there was every reason to believe that emphysema had, to a certain extent, commenced; and where, along with other indications of advanced emphysema, there was complete absence of murmur of any kind, this peculiar sound has been the first to manifest itself in the course of the re-establishment of the natural respiration. We have observed this phenomenon in one case, the humming sound being present at the commencement of the treatment, and disappearing as the case progressed.

We now proceed to notice the application of this remedy in the treatment of pulmonary consumption. This we know to be a constitutional disorder, consisting essentially in an impoverished state of the blood, generally connected with hereditary taint, and, in most cases, having, as its proximate cause, a disordered state of the digestive system, accompanied by softening and relaxation of the mucous membrane of the stomach, congestion of the liver, and other parts of the digestive apparatus, which disordered state not only precedes, but accompanies, the development of phthisis, giving rise to mal-assimilation of the food, and consequent impoverishing of the blood, which is frequently also deteriorated by the evil influence of indigestible and insufficient food, impure air, damp and dark dwellings, and malformations or imperfect development of the chest. This disordered state of the blood gives rise to the exudation, in certain of the tissues, of the morbid product denominated tubercle, microscopically characterized by its corpuscles, molecules, and granules, whose relative proportions appear to vary with the more or less perfect nutrition and vital powers of the subject. The exudation of this product into the air-vesicles is always preceded by a softened, relaxed, and almost villous condition of their mucous membrane, with increased secretion; which state, interfering with the access of air to the capillaries, speedily gives rise to congestion, followed by the exudation, in a fluid state, of the tubercular matter. This soon solidifies; and, being incapable apparently of anything beyond the lowest degree of organization, subsequently undergoes various changes, having for their object the removal from the system, or the absorption, of this foreign matter. This process is a curative effort on the part of nature, and is occasionally successful when the further deposit of tubercle is in any way prevented. Disintegration takes place in the solidified exudation, which may then be removed by absorption, should the state of the system permit, or it may be expelled by expectoration; and, in either case, the cavity left may heal up, as recent observations have demonstrated. Or we may have changes taking place of such a nature as to render the tubercle obsolete, either a removal of its animal ingredient leaving a mineral mass behind, or conversion into a substance of a denser

consistence than tubercle not subject to similar changes, with contraction and condensation of the surrounding parts. During the process of softening, we have a state of local excitement; the pulmonary parenchyma is congested, as well as the bronchial mucous membrane, at first in the immediate vicinity, but afterwards more generally,—circumstances which combine to interfere still further with the function of the lungs, and give rise to still more serious constitutional disturbance.

The compressed-air bath exerts its influence in phthisis, both locally and constitutionally. In the morbid state of the pulmonary vesicles, which we have described as preceding the exudation, it gives tone to the relaxed mucous membrane, diminishes the excess of secretion, and thus giving free entrance and exit to the air, removes or prevents the state of congestion, so favourable to the deposition of the morbid product; while, at the same time, by increasing the capacity of the chest, and presenting a larger amount than usual of oxygen to the blood, it facilitates the circulation in the whole pulmonary apparatus, and increases the vital power of the whole system. Moreover, we believe that, in consequence of these effects, the mutual actions taking place between the systemic capillaries and the tissues they nourish will also be quickened and facilitated, and thus congestion will be relieved, wherever it exists—as we know it does in most such cases in the digestive organs. This physiological action is still farther aided by the mechanical effect of the deeper inspirations and greater expansion of the chest we have shown to be produced, which, as Sir D. Barry's experiments demonstrate, accelerate the flow of blood in all the veins contiguous to the thorax; and thus, through the hepatic system, the whole digestive apparatus is relieved, the nutritive power augmented, and the state of the blood improved. And, besides this, there is a special action of the compressed air on the mucous membrane of the stomach, similar to that exerted in the lungs, giving increased firmness, and freeing the tubular structure of the granular matter which, in this kind of dyspepsia, more or less blocks it up, and diminishes the secretion of gastric juice. The augmented flow of saliva, also, will have an auxiliary effect, both as assisting in the digestion of the amylaceous matters, and tending to neutralize the excessive amount of acidity so constantly present.

It is plain, therefore, that, even after tubercle has been deposited in some part of the lung, its farther deposition is, by the use of this means, prevented—the conditions of the mucous membrane, essential to its deposition, being removed, without, at the same time, inducing any irritation—and the vital powers also augmented. But, besides this, it stimulates the mucous membrane to absorb the tubercular matter, as we have observed to take place in a lung, one-third of which, at least, was filled with the deposit. We have watched the absorption of this deposit from week to week, until every trace of tubercular matter has disappeared, and the natural respiratory

murmur returned. We have observed instances where dulness of percussion, harshness of inspiration, prolonged expiration, and increased vocal resonance, have been succeeded by fine mucous sounds, which gradually disappeared, followed by a gradual return of the normal sounds; and others, where loud mucous râles have been perceived over the whole chest, with scarcely a vesicular murmur audible, where the mucus has gradually, as it were, dried up, giving place to the natural breathing. But, farther, we have noticed an instance, where every indication of a cavity existed, in which the loud mucous râles have given way, and the increased vocal resonance been reduced, till ultimately all cavernous sounds have disappeared.

We would here notice the very interesting fact of the close resemblance of the phenomena observable during the process of absorption of tubercular deposit, to those which accompany the removal of pneumonic exudation. In the latter case, we find the tubular breathing becoming gradually less pronounced, and mingled with the "*rhonchus crepitans redux*" indicative of the softening of the deposit; which, after a variable time, gives place by degrees to the vesicular murmur, the dulness of percussion and increased vocal resonance also gradually disappearing, till the affected parts are restored to their former condition. Similar phenomena we have had opportunities of observing as the result of the treatment of phthisis by compressed air. Cases have come under our notice, where the natural vesicular murmur had completely disappeared, being replaced by harsh bronchial sounds, with dulness on percussion, increased vocal resonance, and depression of the affected part,—all indicative, when taken in connection with the other features of the case, of deposit of tubercle. We have traced from week to week the softening of the harsh and bronchial sounds, the manifestation of mucous râles, of greater or less intensity, continuing for a time, and accompanied by slight constitutional disturbance, and diminution of the vital capacity of the chest. The mucous sounds then gradually gave place to the vesicular murmur, while the dulness of percussion lessened, vocal resonance became less loud, and the expansion of the lung at the affected part manifestly increased.

All these favourable actions are, moreover, materially aided by the sedative action of the compressed air on the arterial circulation—a fact of the highest importance, when we consider how very frequently, in phthisical cases, we have to combat accelerated circulation and general excitement. That this sedative action is not dependent merely on amelioration of the pulmonary affection, is shown by the fact, that it is manifested quite as strongly, and often indeed more so, in cases where no pulmonary affection could be supposed to exist. It is, in some measure, explicable by the facilitation we have shown to take place, of the flow of blood in the pulmonary and systemic capillaries, and the acceleration of the venous current, relieving, to some extent, the heart, in its function of propelling the blood through

those parts of the circulatory system. But this will by no means entirely account for the phenomena. Although, in many persons, no particular alteration is observed in the state of the pulse or general circulation, yet, if the heart's action is morbidly increased, and sometimes, even when it is not so, the general effect of the condensed air is to reduce the force and frequency, and regulate the rhythm of the pulse. We have had occasion frequently to notice this, and the cases of Bertin and Pravaz prove that the frequency of the pulse is often remarkably diminished during the sitting in the bath, even from the first; in other cases, the effect is not immediate, but may be manifested after a night's rest; and, in many, the effect continues, at least to some extent, even after the patient has ceased to use the bath. In one case of emphysema, related by Bertin, the pulse fell, during the first sitting, to 72, though habitually 106 or 108. It gradually decreased from day to day, till it was only 45, at which point it remained during the treatment, and for long after it did not rise above 56. In a case of nervous palpitation, the subject of which had long used preparations of digitalis, which had never succeeded in bringing the pulse lower than 60, after the second sitting in the bath it was no more than 45. In a patient of our own, a lady, who had suffered for ten months from nervous palpitation, fluttering and stopping of the heart, with other symptoms, such as alarming sensations in the head, frequent yawning, and efforts at deep inspiration, the pulse formerly almost never below 96, and frequently, especially after meals, rising to 120, was found, on the morning after the first bath, to have fallen to 84; after the seventh, to 72; and the effect of eight baths was such, that the pulse was reduced to an average of 82, sometimes falling to 72, and never rising above 96—while the other symptoms were also relieved. Here the effect was more marked the day following than immediately after the bath.

The compressed air has at once a stimulating and a sedative effect on the heart, diminishing the irritation of its nerves, and increasing the vigour of its muscular tissue; and, where degeneration has commenced in this tissue, this is removed, and replaced by healthy structure.

It is almost unnecessary to point out the importance of these actions on the mucous membrane and the circulation in cases of hæmoptysis, depending as it does on low vitality of the blood, softened state of the mucous membrane, and congestion of the tissues, and so frequently accompanied by rapidity of the circulation.

The effect produced on the capillary circulation, and that of the venous system, suggests the application of this agent in congestion, not only of the abdominal organs, but also of the brain and spinal marrow, the veins of which, from their position and relations, are particularly exposed to the effects we have observed to be produced by increased inspiration, their connections not admitting of that flapping together of their walls, which in more superficial veins pre-

vents this effect being felt to any distance. It would appear, from certain cases of Pravaz's, to be of use also in incipient softening of the brain, in epilepsy, and in hemiplegia.

We formerly adverted to the mechanical effect of the compressed air, illustrated by its action in the case of the Eustachian tube. This, in conjunction with the actions on the mucous membranes, is of use in certain cases of deafness, depending on occlusion of that canal, affording a safe substitute for the practice of catheterism. In such cases, Bertin recommends that the pressure should be applied in oscillations, raising and depressing it occasionally during the sitting. Similarly, it is of use in cases of sterility, depending on a relaxed state of the lining membrane of the cervix uteri and Fallopian tubes; and its stimulant action in these organs has been proved by increasing their secretions, when these have been deficient; and we have observed two cases, in which menstruation had been for years suppressed, and the patients had been subjected to all the ordinary methods of treatment without success, where, after a few sittings in the air-bath, the menstrual function was restored.

This action of the remedy is of very great importance in the treatment of phthisis, where the periods are so frequently suppressed, and so difficult to restore by any other means.

While maintaining the very high value of compressed air in the treatment of phthisis, and its great importance as supplying a means, which as yet had not been attained, of acting directly on the mucous membrane of the lung, so as to produce the beneficial effects we have stated, at once preventing farther deposit, and stimulating and aiding the curative efforts of nature, we would not be supposed to advocate the employment of this agent to the exclusion of other hygienic and therapeutic measures. We believe, on the contrary, that, without a systematic combination of these measures, the results we have stated may fail to be realized; that, while each branch of the system is of importance in itself, and produces its beneficial effects, it is by the combination of the whole that the wished-for result, the cure of phthisis, is to be attained. It is of the utmost importance, in the first place, that the patient be removed from all causes tending to foster his disease, and placed in a situation where the air is pure and bracing—if possible, midway up a hill, and on a dry sandy soil; and that, while the interior of his residence is, in cold weather, kept equably warm, at a temperature of about 60°, and, at the same time, thoroughly ventilated, he should not be closely confined to it, except when the weather is decidedly unfavourable, but should take daily out-door exercise, by walking, riding, or driving, as far as his strength will permit without fatigue. His diet must be nutritious and unirritating, and his clothing comfortable, but not heavy. On these points we cannot help quoting the admirable remarks of Mr Bodington, in his work on "The Treatment and Cure of Pulmonary Consumption," published in 1840, when medical men were much less disposed than they are now

to give their assent to the rational principles of treatment he advocates.

“ The most important remedial agent in the cure of consumption, is that of the free use of a pure atmosphere; not the impure air of a close room, or even that of the house generally, but the air out of doors, early in the morning, either by riding or walking; the latter when the patients are able; but generally they are unable to continue sufficiently long in the open air on foot, therefore riding or carriage exercise should be employed for several hours daily, with intervals of walking, as much as the strength will allow of, gradually increasing the length of the walk, until it can be maintained easily several hours every day. The abode of the patient should be in an airy house in the country; if on an eminence, the better. The neighbourhood chosen should be dry and high; the soil, generally of a light loam, a sandy or gravelly bottom: the atmosphere is in such situations comparatively free from fogs and dampness. The patient ought never to be deterred, by the state of the weather, from exercise in the open air; if wet and rainy, a covered vehicle should be employed, with open windows. The cold is never too severe for the consumptive patient in this climate; the cooler the air which passes into the lungs, the greater will be the benefit the patient will derive. Sharp frosty days in the winter season are most favourable. The application of cold pure air to the interior surface of the lungs is the most powerful sedative that can be applied, and does more to promote the healing and closing of cavities and ulcers of the lungs, than any other means that can be employed. . . . Many persons are alarmed and deterred from taking much exercise in the open air, from the circumstance of their coughing much on their first emerging from the warm room of a house; but this shows that the air of the room was too warm, not that the common atmosphere was too cold. To live in a temperature nearly equal to the latter at all times, should be the aim of the patient, who should avoid warm close rooms as much as possible, and always keep from the fire, taking care to keep the surface of the body warm by sufficient clothing. Thus the equal temperature so much considered, and said to be necessary, should be that of the external air, instead of that so commonly employed, the warmth of a close room.

“ The powerful effect of the early morning air in allaying excitement is so great, and so superior to all other means, that it should, in my opinion, under the eye and by the regulation of the medical attendant, form the foundation of the whole course of treatment; without it, he will not be enabled to administer the due proportion of stimulating and nutritious aliment; it is the proper preparation for the administration of medicinal sedatives; by it the muscular power is preserved from undue exhaustion, and the sanguiferous system from running away to waste; for this course of treatment I have invariably found to diminish the rapidity of the pulse. The profuse nocturnal perspirations are also soon subdued by this method of

treatment, and the great debility they occasion avoided. The skin assumes a healthier action, in proportion to the extent of exposure to the external atmosphere, particularly to the morning air."

In addition to ordinary exercise, we would attach considerable importance also to well-regulated therapeutic movements, as affording a means of expanding the chest, developing the muscular system, and promoting an equable circulation of the blood throughout the entire system.

The next branch of our plan of treatment is the hydro-therapeutic, the judicious employment of water, both externally and internally. Commencing gradually, as the patient's strength permits, with such simple applications as the daily wash-down, we are soon able to go on to the practice of spouting the chest, the tonic and invigorating effect of which is, in most cases, speedily manifested, stimulating and strengthening at once the system and the thoracic organs, and this not only in phthisis, but in other diseases of the chest. In asthma, for instance, we have staved off an impending attack by this simple expedient; and have employed it, with marked success, in conjunction with hygienic measures, in removing the tendency to the asthmatic paroxysm. The use of the chest-compress is also very beneficial. By this means, we may produce a rash, which is followed by an eruption of pustules resembling those caused by tartar-emetic ointment, but without the constitutional disturbance, the irritating and debilitating effect, of that remedy; while the state of the lungs is much more certainly and speedily improved. The towel envelope, and the partial or entire rain-bath, are also employed as occasion requires. By all these means, a healthy action of the skin is secured. The free internal use of pure water, moreover, has a stimulating effect on the kidneys, and assists in the removal of effete matters from the system.

We have next the employment of analeptic medicinal agents, among which the most valuable are cod-liver oil (used both externally by friction, and internally), quinine, and iron. With regard to these we would observe, that more decided and speedy benefit is derived from them, after the means already alluded to have been persisted in for a time, the vital and nutritive forces being thus brought to such a point, as to admit of reparative action taking place under the use of these medicinal agents; and, with regard to iron, we find much more decided benefit to accrue from the use of its milder preparations, such as the wine of iron, the citrate, and its combination with quinine, the syrup of the iodide, alone or with quinine, than from the strong muriated tincture so frequently employed.

The use of the compressed-air bath forms the last branch of our system of treatment. The diseased condition is now assailed on all points. While the other branches are, in their actions, principally constitutional, rousing the vital powers, improving the nutrition of the body, and the state of the blood, removing effete matters, repairing waste, and stimulating the entire system, we have here a means

of exerting a beneficial influence directly on the part where the local manifestation of the disease has taken place, and completing the cure by the removal at once of the morbid matter, and the local conditions which afford it a nidus, and which, after its deposit, are kept up by it, and react injuriously on the entire system.

We have thus candidly stated what we believe to be the true principles on which the treatment of phthisis ought to be conducted, and its cure is to be attained; and we trust and believe that they will speedily be, as indeed they already are to some extent, recognized as such by the medical profession generally.

We now proceed to cite a few cases from the French authors, and from our own experience at Ben Rhydding.

CASE I.—CHRONIC AFFECTION OF THE THROAT. EXTINCTION OF VOICE.—BERTIN.

M. de C., aged 50, was unable from an early period of his life to raise his voice much above the ordinary tone; and later, his voice became still weaker, and he was unable to carry on any lengthened conversation; and he was obliged to abandon his occupation on this account. Five years after this he submitted himself to M. Bertin's treatment.

His voice was weak, hoarse, and deep. The uvula was found very long and tumefied, especially at its free extremity, which rested on the base of the tongue. Tonsils highly engorged; the mucous membrane covering them, the soft palate, and the uvula, intensely injected. No pain, but an uneasy sensation. No cough. On auscultation, it was found that, in the whole extent of both lungs, the expiratory and inspiratory murmurs were replaced by a continuous humming sound. Clear sound, on percussion, in all parts of the chest. Pulse regular—60. At the first three sittings, on account of the nervous susceptibility of the patient, the pressure was not raised above 26 centimetres (about 5 lbs.) A slight improvement was manifested after the second bath; but the morning after the fourth, during which the pressure had been raised to 30 centimetres, the redness had disappeared from the soft palate, and traces only remained in the uvula and tonsils. The voice was improved, more firm, and of more natural tone, and the uneasiness of the throat almost gone. After the fifth, in which the pressure was carried to 35 centimetres, the voice had almost entirely regained its strength and tone. The respiratory sounds were distinct, though still weak. After the eighth bath, his voice had entirely recovered its clearness, and he was able, without any bad result, to carry on a prolonged conversation. The tonsils were no longer engorged, and the uvula had resumed its natural state and density.

CASE II.—DO.—BERTIN.

In another case, similar to the foregoing, where the voice was so feeble as to prevent the patient reading aloud for more than a few minutes, and the least conversation brought on hoarseness; during the sustained high pressure of the first bath, the patient was able to read aloud, without difficulty, for half an hour.

CASE III.—CHRONIC BRONCHITIS.

A. B., aged 18, presented himself for treatment at Ben Rhydding, Dec. 1, 1856. Has had, ever since his infancy, a habitual short cough, and has been subject to colds at intervals, especially in winter. For the last two or three winters, the cough and expectoration have been on the increase. The latter is especially abundant after dinner, and is thick and greenish. He has never spit blood, except on one occasion, about four years ago, when he had over-exerted himself at cricket. Slight pain, occasionally, at upper part of sternum. Lying on his back, or with his head low, or going up hill, brings on dyspnœa. He lies most easily on the right side. Sternum prominent, infra-mammary regions considerably flattened, and expanding very little in inspiration. Percussion elicits a clear sound over the whole chest, especially at the summits of the lungs, and in right lateral region. At the apices, the respiratory sounds are loud, while at other parts they are much diminished in intensity, and in the infra-axillary regions scarcely perceptible. In the left infra-axillary region, distant mucous sounds are perceptible, and in deep inspiration mucous and sibilous râles are heard on both sides. Vocal resonance rather diminished. Vital capacity of chest, 145 cubic inches;¹ weight, 7 stones $4\frac{1}{2}$ lbs.; height, 5 ft. $3\frac{1}{4}$ in.; pulse, 84, small, and weak; other functions regular.

Dec. 9. Has had seven baths, and also mild water treatment. The respiratory sounds during ordinary breathing are more distinct. Mucous and sibilous râles still perceptible in deep inspiration. Feels stronger, his spirits much improved; and remarks that he feels particularly buoyant a short time after coming out of the air-bath. Vital capacity, 160 cubic inches; weight, 7 stones 7 lbs.

Dec. 16. Much improved since last report in appearance, as well as in other respects. Cough and expectoration almost gone; and he can now lie in any position with ease. Respiratory murmur everywhere more distinct; râles very much less intense, and less extensive. Weight, 7 stones $9\frac{1}{4}$ lbs.; vital capacity as before.

Dec. 22. Respiratory sounds natural in all parts of the chest, even during deep inspiration, with the exception of an occasional

¹ The vital capacity was ascertained by Mr Hutchinson's spirometer. We do not, however, attach much importance to the indications afforded by it, nor consider that any very exact conclusions can be drawn from them.

slight snoring sound at one or two points on the right side. No cough. Expansion of chest, especially in infra-mammary regions, much improved. Weight and vital capacity as before.

Dec. 27. No râles perceptible at any part; but the respiratory murmur is still rather indistinct in the right infra-axillary and part of the mammary region, though not so indistinct as at first. Percussion elicits a very clear sound at these situations.

This patient had a course of hydro-therapeutic treatment, along with the use of the air-bath. Since last report, he has been suffering from a boil on the neck, and has not had a good appetite. His weight is slightly reduced. The pain of the boil prevents his using the spirometer satisfactorily.

CASE IV.—CHRONIC BRONCHITIS AND ASTHMA.

G. R., æt. 50, had been subject to asthma for about 27 years, subsequent to an attack, apparently, of acute bronchitis. Ever since then he has been troubled with cough, and increasing dyspnœa, with frequent aggravations of an asthmatic character, occurring especially in severe weather, and at night.

The chest is well developed; the breadth in the lateral regions larger than natural. Percussion elicits a clear sound generally over the chest; indeed, the resonance is rather exaggerated in most parts. On auscultation, there is found scarcely a trace of normal respiratory murmur at the summits of both lungs, the breathing there being bronchial, and towards the bifurcation of the bronchi, snoring. In the rest of the chest in front, frequent cooing sounds are perceptible; and in the inferior regions behind, especially on the left side, there are general sub-mucous râles. His breathing is difficult and wheezing. He has always a slight cough, and occasionally expectoration of a yellow colour. Heart sounds rather tumultuous. Pulse, 108. Tongue rough. Appetite moderate. Bowels regular. Does not perspire much at night. Sleep variable, depending on the cough. Vital capacity, 80 cubic inches. Height, 6 feet. Weight, $10\frac{1}{2}$ stones. Commenced use of the air-bath, Nov. 5. During the first sitting, his pulse fell to 84.

Nov. 11. Since last report, has had six baths. He finds his breathing easier, and sleeps better at night.

The respiratory sounds in the infra-clavicular regions are not so loud and harsh as formerly, the tubes being apparently more moist; while in the posterior inferior regions the mucous râles are much less distinct; and sibilus is not heard anywhere, save at one spot on the left side, beneath the mamma. His vital capacity is now 150 cubic inches, and the exertion of using the spirometer does not bring on, as formerly, a fit of coughing. Weight, 10 stones $10\frac{1}{2}$ lbs. Pulse, 96.

Nov. 18.—Mucous râles perceptible in inferior third of right lung behind, and posterior inferior half of left. No sibilus. Sleep

undisturbed by cough, and feels altogether better. Vital capacity has fallen to 130. Pulse, 82.

Nov. 25.—Has had a slight cold, but the mucous râles are considerably less distinct, and general improvement continuing. Vital capacity, 145. Weight, 10 st. 12 lb. Pulse, 88. Is now having spouting of the back daily.

Dec. 2.—Since last report, the weather has been severe; but he has continued undisturbed by asthmatic attacks at night, and feels in all respects better. The respiratory sounds in the apices of the lungs, and over the upper half of the anterior regions, indicate that the air penetrates much more freely into the air-cells. The respiration is, indeed, in many places, quite puerile; lower down it is not so loud. The small mucous râles are still heard behind, and have rather extended. Vital capacity has again fallen, as it was observed to do in several of the patients during the severe weather; it is now 120. Weight, 11 st. Pulse, 86.

Dec. 9.—Mucous râles not perceptible, being replaced by weak vesicular murmur. He now felt so much improved, though not entirely free of his symptoms, that he left.

We should observe that this patient did not reside in the Establishment.

CASE V.—ASTHMA.

E. F., æt. 25, coachman, height 6 ft. $\frac{3}{8}$ in., of delicate appearance, came to the hospital at Ilkley, Nov. 16, 1856. He had been subject for thirteen months to attacks of asthma, generally occurring at changes of weather, and lasting two or three days. They sometimes, also, were excited by working among hay, the smell of which always caused him to sneeze. He believes there is a hereditary tendency to asthma on his mother's side. Chest highly resonant throughout. Respiratory murmur, during tranquil breathing, heard with difficulty in the summits of the lungs; and, on quick breathing, there is a slight harshness in the respiratory sounds in the upper part of the right lung. During the intervals of his attacks, he feels quite well. Vital capacity, 200 cub. inches. Weight, 10 st. $7\frac{1}{2}$ lbs.

Nov. 25.—Has had six sittings in the air-bath since last report. Changes of weather have affected his breathing, but the attacks have been much less severe. He is pursuing the hydro-therapeutic treatment also. Dripping sheet in the morning, and spouting of back and chest twice-a-day. Weight, 10 st. $9\frac{1}{2}$ lbs. Vital capacity, 215 cubic inches.

Dec. 2.—Had a slight attack of asthma on the morning of the 30th, but of very short duration, as he was quite well again on getting up. Respiration is heard more distinctly in the summits of the lungs. Weight, 10 st. 12 lbs. Vital capacity, 225 cubic inches.

Dec. 9.—No attack since last report. Respiratory sounds every-

where more distinct. Weight, 10 st. $13\frac{3}{4}$ lbs. Vital capacity, as before, 225.

Dec. 12.—Left to-day, decidedly improved in all respects, and has continued well since.—(Dec. 25.)

On 2d January 1857 he writes—"I am glad to say, that, since my return home, my breathing has continued much the same as when at Ilkley. Although I have had a severe cold for nearly a fortnight, which has affected me other ways, yet my *breathing* has not been affected, at which I am rather surprised. I have sometimes felt a weight and pain in my chest, especially after doing any dusty work, attended with great uneasiness, and loss of appetite; also a continued sneezing, as if I had a cold."

CASE VI.—ASTHMA, WITH EMPHYSEMA.—BERTIN.

M. M., æt. 48, became subject, at the age of 36, to slight attacks of dyspnœa, by degrees becoming more violent; and for several years he had a serious attack of asthma about once in three months, presenting all the usual phenomena in a marked degree. The affection seems to have been hereditary. Respiration easily affected by rapid walking or ascent. Decubitus on left side, or with head and shoulders low, impossible. Abnormally clear sound, on percussion, over the whole chest. Respiratory murmur natural at summit of left lung, but very feeble in the remainder of its extent; scarcely audible at the summit of the right, and totally inaudible in the rest of that organ, except behind, at the lower part, where it was very feeble, and mixed with a small mucous râle. On the right side, also, a little sibilant râle was perceptible here and there. Heart's pulsations not easily felt, and the sounds dull. Feeling of weight in the head.

The first bath produced great freedom of respiration.

After the second, the patient passed a more quiet night than usual, and the head was relieved.

After the fourth, the respiratory murmurs had resumed their natural intensity throughout the whole of the left lung. In the right, they had more strength at the summit; and, in the remainder of the front of the chest, they could now be feebly heard, accompanied by a kind of dull mucous râle. The sibilant râles had entirely disappeared. Behind, the vesicular murmur more distinct, and the mucous râles gone.

The patient felt his breathing more and more easy. The urine, formerly much loaded, had now become clear.

The patient continued to improve, in spite of an exposure which formerly would have caused him much uneasiness; and after the tenth bath, he could ascend a stair without the least oppression. After the fourteenth bath, the respiratory murmurs were distinctly heard throughout the whole chest, and perfectly free of all râle. Heart's pulsations more distinct. After sixteen baths, the treatment

was given up. The patient could, without difficulty, take deep inspirations, walk rapidly, and lie in any position. His general health also was greatly improved; and several years after, no return of his malady had taken place.

CASE VII.—NERVOUS ASTHMA, WITH EMPHYSEMA.—BERTIN.

M. R., æt. 28, had attacks of asthma from his twelfth year, at first passing off in the course of a night, but, after $2\frac{1}{2}$ years, becoming more violent and more prolonged; and he experienced relief only by inhaling the smoke of match-paper. He came to Montpellier, and commenced the use of the air-bath while suffering from an attack.

Percussion elicited a clear sound over the whole chest. The vesicular murmur was not perceptible at any part, and was replaced by an acute sibilant râle, which, in the left lung, was heard only during expiration.

Pulse 100, frequent, small, and regular. Severe headache.

During the first bath, the patient experienced greater freedom of breathing, and the pulse fell to 90.

By degrees, the attack of asthma gave way; and, after the seventh bath, the sibilant râle was heard only in one or two points in each lung. Still, throughout the whole of the right lung, the natural vesicular sound was wanting; and in the left, it was perceptible only in the upper third. Pulse, before rising in the morning, 90. The patient could walk with greater ease.

After the ninth bath, his appearance indicated greater calm, and the pulse had fallen to 66. After the eleventh, inspiratory and expiratory murmurs were audible in the whole of the left lung; a feeble sibilant râle at the end of inspiration in the upper third. In the left, the respiratory murmur was heard in the whole posterior region, and in front in the upper third. Pulse 66; appetite increased.

After the twelfth sitting, an error in regimen brought on a slight attack of oppression, lasting for a night. The sibilant râle reappeared in the whole of the right lung, and also in nearly the whole of the left; while, under the clavicle, there was a continuous humming sound.

After the eighteenth sitting, the respiratory murmur was restored in the right lung, and there was a considerable improvement in the left. The pulse had never risen above 72, and now soon returned to 66, and, after the nineteenth bath, it was 60, and fuller. The normal respiration was re-established, after twenty-two sittings, except in the infra-mammary region of the left side. Sibilant râles nowhere to be heard. After thirty-five baths, the only derangement was a slight weakness of the respiratory murmurs in the inferior external third of the left side. Pulse 60. General health and embonpoint restored.

CASE VIII.—CHRONIC BRONCHITIS IN A SUBJECT PREDISPOSED TO PHTHISIS.

G. H., a female child, aged 22 months, whose mother died of phthisis, was placed under our care, November 27, 1856.

Her father stated, that she had a severe attack of bronchitis when six months old; ever since which, she has been liable to similar attacks. Was pretty well during last summer, but has been suffering during the autumn and winter. At present, she has a frequent cough, coming on especially on waking from sleep; her breathing is accompanied by a wheezing noise, which can be heard at some distance. Her nights are disturbed. Pulse very rapid; bowels regular; appetite moderate; spirits cheerful.

On applying the ear to the chest, loud mucous sounds are heard over nearly its whole extent, mingled here and there with sibilus. Indeed, the natural vesicular murmur is completely masked, except in about the lower third of the anterior regions. There is slight dulness, on percussion, in the apex of the right lung, where the mucous râles are smaller than elsewhere.

She had the first sitting in the air-bath on the 28th, for one hour—the pressure raised to four pounds. While in the bath, the wheezing, which before was distinctly audible at some distance, could not be heard, except on placing the ear close to the chest; and the pulse fell from 136 to 120. Slept afterwards, and awoke without coughing.

Next morning (29th) she awoke without coughing, after a quieter night than usual. Mucous sounds not so loud. Bath as before.

Dec. 1. No bath yesterday. Did not sleep so well last night, and there is rather more cough, but looser. Had the bath, at 5 lbs., for an hour. After it, the mucous sounds were found diminished, and vesicular murmurs could be distinguished in several places.

Dec. 2. Another restless night. Cough continues; bath at 6 lbs. for an hour and a quarter. Appetite rather impaired for the last day or two. Had been taking, till yesterday, a small quantity of syr. scillæ and vin. ipecac. occasionally. This is now omitted. In the evening, viscid mucous râles and slight sibilus heard pretty generally over the chest, mingled on the right side, behind, with vesicular murmur. Has been rather restless after sleeping.

Dec. 3. Bath at 6 lbs. for upwards of an hour and a half. In the evening, the mucous râles were almost gone, but a deficiency of respiration in the lower parts of the lungs.

Dec. 4. Viscid râles heard as before both morning and evening.

Dec. 5. No bath to-day. Has not had much cough. In the morning, the râles were perceptible as before, but in the evening they were heard only here and there. Sleeps well.

Dec. 6. Air-bath for two hours on and after this date. Cough less frequent and less hard; pulse diminished in frequency. In the evening, râles are heard in both lungs, such as to indicate a diminu-

tion and more viscid state of the mucus; but in the right, especially, there is a large mixture of vesicular murmur.

Dec. 7. A severe fit of coughing this morning. The nurse gave her a few drops of vin. ipecac., after which she brought up a quantity of white mucus. Râles heard all over the chest.

Dec. 8. Again a good deal of cough this morning, but the natural respiration is heard more distinctly in the right lung. In the evening, the râles sounded drier.

Dec. 11. Vesicular murmur is more perceptible, not only in the right lung, but also, at intervals, in the left. Appetite much improved.

Dec. 19. Since last report, the patient has gradually improved in all respects. The vesicular murmur is heard behind over the whole right lung, though mingled with mucous râles; the amount of mucus, however, being evidently less. A little vesicular murmur in front, in the infra-clavicular region; but mucous râles only are heard in the rest of the lung. In the left lung, the natural murmur is more perceptible at the base posteriorly.

Dec. 20. No mucous sounds to be heard in the right lung, except at the summit, and slightly at one or two points in front. Those in the left, also, are much diminished, especially behind. Cough very trifling; appetite much improved.

Dec. 23. There has been rather more wheezing in the breathing since last report; but, on examination this evening, though sibilous râles are heard here and there, healthy vesicular murmur continues to extend in both.

Continues under treatment. This patient had also cod-liver oil in small doses, rubbing of the chest, and wash-down, and wore a compress over the whole chest.¹

CASE IX.—PHTHISIS.

J. K., æt. 20, came under treatment November 18, 1856. He stated that he had a severe attack of hæmoptysis six weeks ago, which has recurred occasionally since, but by no means to the same extent. He had been affected with cough for about a month previous to this. After the first attack of hæmoptysis, he had profuse perspirations at night, but he is now free of this. He has a slight cough, bringing up a whitish expectoration, occasionally tinged with blood. No dyspnœa. Has been getting thinner. Mother died of phthisis. Vital capacity 190; height, 5 ft. 5 in.; weight, 8 st. 8 lbs.

On examination of the chest, the infra-clavicular regions appear bulging, but this arises from largely-developed muscle. Expansion at apex of right lung less than that of left; pretty well-marked

¹ Since the above was written, the progress of this case has shown it to be one purely of phthisis, the subsidence of the extremely thick and loud râles enabling us to make out the signs of a cavity in the apex of the right lung. The patient continues to improve daily.

dulness under right clavicle for about an inch and a half downwards, and also in right axillary region. Percussion elsewhere produces normal resonance. In the above-mentioned localities the respiration is harsh and bronchial, the expiration prolonged, and vocal resonance bronchial. Respiratory murmurs rather indistinct in left infra-axillary region. Complains of a slight wheezing in his breathing at night. Appetite good; bowels regular.

Nov. 24. Bath at 6 lbs., for two hours daily, since last report. Respiratory sounds at affected parts less rough, but accompanied with soft mucous râles. He complains of pain at a spot underneath right clavicle, apparently muscular. Vital capacity, 180; weight, 8 st. 9½ lbs.

Dec. 2. Pain formerly complained of considerably less; mucous râles continue at upper part of left lung, but mingled with vesicular murmur. Vital capacity, 165; weight, 8 st. 11 lbs.

Dec. 9. Pain of chest quite gone; has been perspiring rather profusely at night lately, the weather having suddenly become mild. Still complains of the wheezing at night; sounds rather less harsh; mucous râles heard on deep inspiration only. Vital capacity, 172; weight, 8 st. 12 lbs.

Dec. 16. Considerable improvement in the auscultatory signs since last report, the sounds being softer and expiration less prolonged. Dulness on the right side less marked. Vital capacity, 175. Weight, 8 st. 12½ lbs.

Dec. 22. Still slight harshness and prolonged expiration, but confined now to the space immediately under the clavicle. No mucous râles, except a little behind in the right bronchus. Vesicular murmur extending throughout the apex of the right lung. Vital capacity, 170. Weight, 8 st. 13½ lbs. No wheezing at night. No cough. Continues under treatment.

CASE X.—PHTHISIS.

L. M., æt. 19.—Examined Oct. 30.—States, that about three years ago, after over-exerting himself, he was attacked with hæmoptysis, which was severe, but yielded to remedies. After six months he had another attack. Previous to the first, he had been gradually getting weak, and had been taken from school on that account. The hæmoptysis again returned last Christmas. He has had occasional cough, but never at all troublesome. Until his first visit to Ben Rhydding (Sept. 1855), he got gradually thinner, and his weight was only 8 st. 1 lb.; but during his stay he improved very much, and when he left, he had gained 11½ lbs. His weight now is 8 st. 12½ lbs.

On examining the chest, there is found a slight depression of the infra-clavicular regions. Percussion is pretty clear over the front of the chest. Slight dulness under right clavicle, and more marked over the third and fourth ribs, near the sternum. Dulness in right

axillary, and slightly in lower third of both lungs behind. Small mucous râles are heard at the summit of both lungs, a slight snoring in the left bronchus, as well as at the roots behind. Mucous râles, louder than those at the summit, are heard in lower third of both lungs behind. At the spot mentioned above, on the right of the sternum, there are the usual signs of a cavern, though of small extent, in the respiratory sounds and vocal resonance. Vital capacity, 130 cub. inches. Height, 6 feet.

Nov. 11. Has used the air-bath regularly since last report. A marked change has taken place in the chest. Mucous râles are much less perceptible at the summit of the lungs. In the right lung behind, the vesicular murmur is restored, and the mucous sounds, in the left side behind, are much diminished. No snoring sounds. Cavernous sounds not so loud. Enjoys a feeling of great ease in the bath. Vital capacity, 140 cub. inches.

Nov. 18. Mucous râles entirely gone, except over a small space to the inner side of the angle of the left scapula. Respiratory murmur at upper part of right lung rather bronchial. Vital capacity, 150. Weight, 9 st. $\frac{1}{2}$ lb.

Nov. 25. Extent of mucous sound on left side rather diminished. Vital capacity, 160.

Dec. 2. Farther improvement in left lung. Weather has been very severe since last report, but has not suffered from it.

Dec. 9. Mucous sounds in left lung are now almost inaudible, and their extent is very limited. The vesicular murmur is more distinctly heard in the apices; and, where formerly cavernous sounds and pectoriloquy were manifested, the sounds are merely bronchial. Vital capacity, 170.

Dec. 22. The mucous sounds in the left lung are gone. The respiratory murmur is rather weak where they existed. Vesicular murmur at summits of both lungs. Dulness less marked there, and not perceptible elsewhere. Vital capacity as before. Weight, 8 st. $13\frac{1}{2}$ lbs. Continues under treatment.

CASE XI.—PHTHISIS.

N. O., æt. 28, dates his ill-health from about four years ago, when he overtaxed his strength by hard study, and became subject to cough and attacks of hæmoptysis, which have occurred at intervals since. Resided some time at Madeira, without benefit.

On examination, Oct. 4, 1856, there is found marked dulness of percussion in the infra-clavicular regions on both sides, and less so in the remainder of the anterior regions, especially on the right side. Mucous râles are heard generally over the chest, especially at the summits of the lungs. Below the left nipple, bronchial sounds are perceptible. He has not much cough except at night. He suffers from dyspnœa on making even slight exertion, and can-

not walk any distance without bringing it on. Skin cold. Hands livid. Expression of countenance rather anxious. Appetite good. Bowels regular.

Oct. 29. Since above date, he has improved considerably under the hydro-therapeutic treatment. Breathing less oppressed. Mucous râles not so general over the chest, and under the right clavicle they are not so large as formerly. Pulse, 100. Weight, 9 st. 9½ lbs. Vital capacity, 60 cubic. in. Height, 6 ft.

Commenced the use of the air-bath yesterday; and, during the sitting, found his breathing much relieved. Pulse fell to 92, but rose again as the pressure was reduced.

Nov. 4. Breathing easier, especially while in the bath. Symptoms otherwise slightly improved. Vital capacity, 73. Pulse, 92.

Nov. 11. Respiratory sounds have undergone a manifest improvement. The mucous râles are diminished in loudness throughout the whole chest, especially on the left side, where, indeed, they are scarcely perceptible. Breathing easier; voice more distinct; spirits more cheerful; and general appearance improved. Pulse, 90. Vital capacity, 80.

Nov. 18. Has now had 18 sittings in the air-bath. Râles less loud, and but little heard on the left side. Pulse, 96. Weight, 9 st. 11 lbs. Vital capacity, 80.

A troublesome and offensive discharge of mucus from the nose, which he had for three weeks before commencing the air-bath, and the whole of last winter, has now entirely ceased.

Nov. 25. Slight improvement, though not so rapid as before. Lower half of right lung remarkably free from morbid sounds. Vesicular murmur spreading. Vital capacity as before. Weight, 9 st. 12 lbs.

Dec. 2. Notwithstanding the severe weather of the last week, he continues to improve. The vesicular murmur is more manifest in almost all parts of the chest; the mucous râles still further diminished; and, in the inferior third of both lungs, posteriorly and laterally they have all but disappeared. He can now ascend the stairs with much greater ease. Weight, 9 st. 10½ lbs. Vital capacity, 65. Pulse, 84.

Dec. 9. Mucous sounds on right side smaller, and mingled with vesicular murmur. On the left, mucous sounds are not heard except in superior third in front. Cough much less. Pulse, 84. Vital capacity, 70.

Dec. 16. He noticed a little blood in his expectoration this morning, and had a little tightness over the left nipple, but otherwise he feels better. Coughs very slight, and breathing easier. Mucous râles are rather more extensive on the right side. Weight, 9 st. 10 lbs.

Dec. 22. Mucous râles less loud in right lung. Vesicular murmur extending everywhere, particularly in lower half. Left side also improved; but mucous râles are still heard in upper anterior

half. Pulse, 90. Vital capacity, 75. Weight, 9 st. 9½ lbs. Continues under treatment.

Besides the air-bath, this gentleman has been using cod-liver oil, rubbings of the chest and back, spouting of chest, and occasional back rain-bath.

CASE XII.—PHTHISIS.

P. Q., æt. 21, came to hospital at Ilkley, Nov. 14.

On examination, there is found a suppurating sore over the upper part of the sternum and left side of the neck. Its edges are livid and undermined. Glandular swelling under the chin, about the size of a small walnut.

Considerable flattening under both clavicles, particularly the right, which also gives, on percussion, a duller sound than the left, which is slightly dull. On auscultation, it is found that, on the right side, from the clavicle to the level of the nipple, the respiratory sounds are harsh, and the expiration rather prolonged, and rather loud mucous râles are heard near the margin of the sternum. Vocal resonance in this situation increased. On the left side, there are loud, but rather more viscid mucous râles, from the clavicle to the nipple; more moist râles in the left axilla, and near the sternum. He has a frequent cough, bringing up a whitish or greenish expectoration. Breathing much oppressed on making exertion.

Hepatic dulness extends to about two inches below the edges of the ribs, and extends across to left hypochondrium. There is bulging at this situation, and considerable tenderness. Appetite not very good. Tongue clammy. Bowels regular, on the whole. Pulse, 130. Vital capacity, 100 cubic inches. Height, 5 feet 3½ inches; weight, 8 st. 3½ lbs. His illness appears to date from about three years back. Cough has been present only seven months. The ulcer on the neck and breast is the result of abscesses opened about three and a-half months ago. He has become weaker and thinner latterly, and has suffered from dyspepsia four or five years.

Nov. 25. Has had the air-bath only three times since last report; but has had short towel-packs daily, and wash down in the morning. Compress on the sore.

To-day he has a slight attack of bronchitis; cooing râles are heard in left lung, especially in lower half. Feels, on the whole, stronger. Weight, 8 st. 7 lbs. Vital capacity, 105. To continue treatment as before, and have the back spouted once a day for two minutes.

Dec. 2. Has had the bath five times since last report. The mucous râles, on both sides, are most decidedly diminished; not so loud, nor so viscid in the left side. Tenderness over the liver gone. Pulse continues rapid.

Vital capacity, 115.

Dec. 9. Mucous râles still farther diminished, being almost in-

audible on the right, and distant on the left side. Harshness considerably diminished in superior region of right lung. Feels, on the whole, better and stronger, and his appearance is by no means so sallow and unhealthy. Still coughs at night. Has, however, lost weight, being now 8 st. $5\frac{3}{4}$ lbs.; and pulse continues quick.

Dec. 16. Mucous râles are not heard in the right lung, and are softer in the left, and harshness in the apices less. Mucous râles still perceptible in left axilla. Edges of ulcer are now adherent to the surface, except at upper part. Appetite improved, and digestion good. Pulse rather weaker, and continues to lose weight. To leave off towel-packs, continue wash down and spouting, and to take a dessert-spoonful of cod-liver oil twice a day.

Dec. 23. Mucous râles are again distinguishable, though not extensively, on both sides; but vesicular murmur extends in both. Has slightly gained in weight. To continue treatment, and take twenty drops of vinum ferri with the cod-liver oil.

Dec. 27. Vesicular murmur audible throughout nearly the whole of the affected parts. Slight mucous r  le towards outer end of right clavicle, but not elsewhere. Cough better. Expectoration whitish, and scanty. Continues under treatment.

CASE XIII.—PHTHISIS.—PRAVAZ.

M. G.,   t. 34, subject to obstinate catarrhal affections, had, in May 1849, an attack of catarrh, complicated with laryngitis and occasional aphonia, cough, especially in the morning and during the night, with fever. Digestive organs disordered. Respiratory murmurs much weakened, especially at summit of left lung. Prolonged bronchial respiration and bronchophony, sibilant and bronchial râles, and moist crepitation at summit of both lungs, and dulness of percussion. Expectoration abundant, streaked with blood. Dyspno  a considerable. After undergoing other treatment without much benefit, he commenced, in September, the use of the air-bath and of cod-liver oil. Sixty-five baths removed all his symptoms; and in April 1850 his state was as follows:—General health excellent, and strength restored. No abnormal resonance of voice. Respiration everywhere puerile and clear, excepting a slight indistinctness at the summit of the left lung.

CASE XIV.—PHTHISIS.—BERTIN.

Bertin relates a case of a lady,   t. 26, who, along with all the usual general symptoms of phthisis, had dulness of percussion beneath right clavicle, and in the inferior and posterior part of both lungs, with harshness of inspiration, prolonged expiration, moist râles, and marked pectoriloquy under the right clavicle. Cough, and expectoration of mucus, mingled with portions of tubercular matter. The following was her state after thirty-six sittings:—Pulse, which had been 76, reduced to 57. Expectoration merely of a

pearly matter. Cough entirely gone. Respiration easy. Percussion everywhere clear. Respiratory sounds normal. Pectoriloquy gone, but slight increase of vocal resonance near sternal end of right clavicle. General health and embonpoint restored. Eleven years after, she continued well.

CASE XV.—HÆMOPTYSIS.—BERTIN.

M. O., æt. 26, after a time of much vexation and prolonged fatigue, was suddenly seized with hæmoptysis, which recurred four or five times in the course of eight days, accompanied with symptoms of congestion in the summit of the left lung. The hæmorrhage was checked by the ordinary measures; and, after a few days, he was submitted to the compressed air treatment. He then presented the following symptoms:—Face pale; whole body emaciated. Respiration short; right side of chest raised more than the left. The least movement, or speaking for any length of time, increased the oppression, and induced a short dry cough, sometimes accompanied with pain in the left side. No fever. In the right side, percussion gives a normal sound; in the left, there is dulness over nearly the whole anterior and a little of the lateral region, especially under the clavicle. In the right, vesicular murmur normal; in the left, feeble, but perceptible, in the posterior and lateral regions; but in front, especially in the upper third, it was almost inaudible, and accompanied with crepitating râles. Deep inspiration brought on cough, and sometimes this brought up an expectoration of muco-purulent matter, streaked with blood. He had night-sweats.

After third bath, the cough did not return in the day-time, manifesting itself only on waking, and the expectoration was unmixed with blood.

Breathing more free. Deep inspiration did not cause pain or cough. Vesicular murmur perceptible under left clavicle.

After twelve baths, the respiratory murmurs were stronger everywhere. Crepitating râles no longer heard under clavicle. After nineteen baths, his health was completely restored.

The hæmoptysis returned afterwards while taking the sulphureous waters of Vernet, but this did not last long; and he returned to the air-baths for a time, with the effect of completely restoring his health.

CASE XVI.—CONGESTION OF LIVER AND HÆMORRHOIDS.—PRAVAZ.

A lady who had long been the subject of engorgement of the liver, often passing into inflammation, had a violent attack of hæmorrhoids. They were scarified with slight relief, but still continued so large, that it was impossible to return them into the rectum.

After two or three baths, they could be returned, and all congestion in the part had ceased. She continued the use of the air-bath at intervals, with the effect of greatly increasing the appetite.

CASE XVII.—PURPURA.—PRAVAZ.

A young woman, æt. 22, was seized with attacks of determination of blood to the head, followed by œdema of the limbs, violet-coloured spots on the skin, burning pain in the chest, spasms in the arms and legs. She was treated by depletion. When Pravaz saw her, she complained of violent palpitations, embarrassment of respiration, and burning pain in the chest. There was bruit de soufflet in the carotids.

After forty-one baths, the palpitation, bruit, and œdema were gone, and all the functions had returned to their normal state.

CASE XVIII.—ANÆMIA FROM UTERINE HÆMORRHAGE.—PRAVAZ.

A lady, æt. 22, from miscarriages and uterine hæmorrhage, was reduced to an anæmic condition, with pallor of all the tissues; distressing palpitations, and œdema of the lower extremities. Iron had been given without producing any improvement. The use of the air-bath soon produced re-establishment of strength, return of appetite and sleep, diminution of the palpitation, and disappearance of the œdema. After sixty baths, symptoms of return of menstruation, which had been long suppressed, manifested themselves, and, soon after, the discharge appeared.

CASE XIX.—MENORRHAGIA.—PRAVAZ.

A lady suffered at each monthly period from menorrhagia, the flow lasting ten or twelve days. She was reduced to an anæmic state, with great weakness. The air-bath at once reduced the duration of the discharge to three or four days; and her other symptoms were rapidly relieved.

CASE XX.—DEAFNESS.—PRAVAZ.

A young man, æt. 28, had for several years been so deaf, that he could not hear the ticking of a watch at a greater distance than one inch from the left ear. He had the air-bath twice a day for fifteen days before any amelioration took place. He then began slowly to improve; and, at the end of two months, a watch could be heard at a distance of eighteen inches. He was then obliged to leave Lyons for a time; but continued to subject himself, several times a day, to a pressure of one-tenth of an atmosphere in an apparatus used in his father's manufactory. Six months after leaving Lyons, he could still hear at a distance of twelve inches. He then returned to Dr Pravaz's establishment; and, after two months' further use of the air-bath, a watch could be heard when held in his outstretched hand.